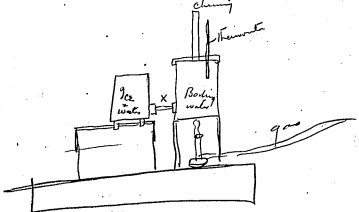
Notebook, N-01-04-19

This notebook is a continuation of N-01-04-16. The only dated entries are from April 1901. It contains notes by Edison and an unidentified experimenter regarding tests of various alloys for use in thermocouples. The metals tested include antimony, bismuth, lead, nickel, tin, and zinc. At the beginning of the book is a drawing by Edison illustrating the apparatus used in the experiments. The front cover is labeled "Thermo Battery Alloys & Experiment." The pages are unnumbered. Approximately 100 pages have been used.

1901

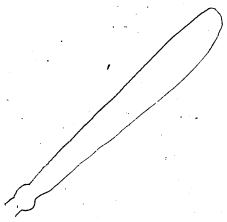
April 19 1901

Thermoelectric battery Experiments



x stick alloy to Gz tested.

		Voltage	Remarks
99 Sb	1 Zn	1/10 of 1 deg	opposite
98	2	1/10 of 1 deg	"
97	3	2/10 "	"
96	4	nothing	"
95	5	2/10 opp	"
94	6	1/10 deg	opp
93	7	Nothing	
92	8	Nothing	
91	9	Nothing	nothing
90	10	[illegible]	1/10 deg opposite



Apl 19 1901

	2w	5b	
89	2Bk	11	5b	1/10 of deg
88		12		" " "
87		13		" " "
86		14		" " "
85		15		" " "
84		16		2/10 "
83		17		" "
82		18		3/10 "
81		19		3/10 "
80		20		3/10 "
79		21		" "
78		22		4/10 "
77		23		" " deg
76		24		1/2 "
75		25		1/2 "
74		26		1/2 "
73		27		1/2 "
72		28		1/2 "
71		29		7/10 "
70		30		1/2 "
69		31		6/10 "
68		32		1/2 "
67		33		1/2 "
66		34		7/10 "

Zn	Sb	
65	35	1/2 deg
64	36	1/2 "
63	37	"
62	38	"
61	39	1 deg —
60	40	9/10 deg
59	41	8/10 "
58	42	9/10 "
57	43	8/10 "
56	44	9/10 "
55	45	1 deg
54	46	1 "
53	47	1.3 deg
52	48	1.5 "
51	49	1.9 "
50	50	1.5 "
49	51	2.5 "
48	52	3.1 "
47	53	4.1 "
46	54	2.2
45	55	2.2
44	56	6.2
43	57	9.5
42	58	5.8
41	59	6.8
40	60	6.3
39	61	6.1
38	62	5.7

not filed- filed 8/10 deg

not filed- 1 deg filed —

S —

Very brittle -
So brittle all broke piece 1/4 longer
not so brittle
still less
abt same
Brittle -
"

Zn - Sb

37	63	7.5 dep[-bad alloy
36	64	12.8" Little Grille
35	65	10.5"
34	66	9.5"
33	67	10.2 Little Grille
32	68	9.6
31	69	8—
30	70	7
29	71	5.3
28	72	6.9
27	73	6
26	74	1.8
25	75	6.2
24	76	6.5
23	77	4.2
22	78	11.
21	79	5.8
20	80	4.9
19	81	4.8
18	82	4.5
17	83	5
16	84	3.9
15	85	3.2
14	86	3.9
13	87	4.5
12	88	2.9
11	89	4.
10	90	3.5
9	91	3.5

S

S

S

8	92	2.5
7	93	3.
6	94	1.9
5	95	2.8
4	96	2.1
3	97	
2	98	
1	99	

End thin coating

1056	90Pb	nil
20	80	
30	70	1/10 deg
40	60	3/10 "
50	50	8/2 "
60	40	1/2 "
70	30	3/10 "
80	20	1/2 "
90	10	8/10 "

Sb 90	Sn 10	1 deg
80	20	7/10 "
70	30	5/10 "
60	40	3/10 "
50	50	2/10 "
40	60	2/10 "
30	70	1/10 "
20	80	Nil —
10	90	1/10 opp —

Sb 90	Cd 10	4 deg	
80	20	5.9 "	
70	30	8.8 "	bottle of green
60	40	12.2 "	"
50	50	3.5"	
40	60	1/2 deg	
30	70	1/10 "	
20	80	1/2 "	
10	90	3/10	

Sb 60 Au 40	1/10 dia	
Sb 90 amorphous	3 2/10 "	
Sb 95 "	3.5 "	
Sb 90 Cu 10	2. "	
Sb 80 Cu 20	1 2/10 "	
Sb 70 Cu 30	8/10 "	
Sb 60 Cu 40	3/10 "	
Sb 50 Cu 50	1/10	
Sb 40 Cu 60	8/10	
Sb 30 Cu 70	2/10	
Sb 20 Cu 80	1/10	
Sb 90 Sodium 10	3/10	
Sb 80 " 20	1 3/10	not brittle
Sb 70 " 30	Not Thin	Brittle

Sb 50 Sodium 50	Idiq	
Sb 40 " 60	mil.	
Sb 10 " 90	various	plastic mica
Sb 90 Sulphur 10	Z 2/10	gradually goes lighter
Sb 80 " 20	mil	
Sb 70 " 30	mil	
Sb 60 " 40	mil	
Sb 40 " 60	3 2/10	
Sb 30 " 70	mil	
Sb 20 " 80	mil	
Sb 10 " 90	mil	
Sb 95- ale 5-	3/10	
Sb 90 " 10	5/10 deq	
Sb 85- " 15-	2 5/10	
Sb 80 " 20	2 8/10	
Sb 75- " 25-	3/10	

Stannous Sulfide.	Nil
Barium Manganate	Nil
Magnesium Sulphide	Nil
Proto Sulphide. Lead	1 deg opposite
Cobalt Sulphide	1 3/10 "
Tungsten Phosphide W_4P_2	Nil
Bismuth Sulphide	6 2/10 opposite good metal
Sodium Tungsten Bronze	1/10 made bad ng under over
Sb Sulfide Sb_2S_2	Nil
Platinum Tungsten Bronze	Nil made bad
Cadmium Sulphide - by fusing Cd iodide with Sulfur boiling made high Res	2/10 make it good Something wrong I think
Manganous Sulfide powder used Cup	Nil.

Sulphide Mercury powder used Cup	1 deg Off
Tungsten Sulfide S_2 Powder – used Cup –	2 deg right way
Hemi sulfide. Iron powder	Nil
Nickel Sulfide – fused	1 deg Off –
Copper Sulfide use a powder only 1/32 nd thick wetted end of cup = stick over on –	10 deg Reproducible
Vanadium Di Oxide V_2O_2 black powder used Cup	1.5 deg Off
Vanadium Trioxide V_2O_3	1/10 deg Off

Sb 95 Sb_2S_2 5	3.2 deg
Sb 90 " 10	3.5 "
Sb 85 " 15	3.5 "
Sb 80 " 20	3.6 "
Sb 75 " 25	3.8 "
Sb 70 " 30	3.7 "
Sb 65 " 35	3.7
Sb 60 " 40	3.7
Sb 55 " 45	3.3
Sb 50 " 50	3.6
Sb 45 " 55	3.5
" 40 " 60	3.8
" 35 " 65	3.6
Sb 95 PbS 5	1.5
Sb 90 " 10	1.4
Sb 85 " 15	.8
Sb 80 " 20	.5
Sb 75 " 25	.6
Sb 70 " 30	.5
Sb 65 " 35	.4
Sb 60 " 40	.5
Sb 55 " 45	.8

Sb 50 PbS 50	.4	
Sb 95 CuS 5	2.9	
Sb 90 " 10	2.9	
Sb 85 " 15	2.7	
Sb 80 " 20	2.9	
Sb 75 " 25	3.	
Sb 70 " 30	3.	
Sb 95 SnS 5	1.9	
Sb 90 " 10	.8	
Sb 85 " 15	1.9	
Sb 80 " 20	1.3	
Sb 75 " 25	1.1	
Sb 70 " 30	2.9	

Sb 95 Cobalt Sulfide 5	3.4
Sb 90 " 10	3.
Sb 85 " 15	2.9
Sb 95 CdS 5	2.9
Sb 90 " 10	3.8
Sb 85 " 15	4
Sb 80 " 20	4.9
Sb 75 " 25	4.9
Sb 70 " 30	6.5
Sb 95 Ni S 5	3.
Sb 90 " 10	3.
Sb 85 " 15	2.9

Sb 95 Bi 5	2.5
Sb 90 Bi 10	2.4
Sb 85 Bi 15	2.1
Sb 80 " 20	2.2
Sb 75 " 25	2.
Sb 70 " 30	1.4
Sb 65 " 35	1.
Sb 60 " 40	1.
Sb 55 " 45	.2 opp
Sb 50 " 50	1.6 opp
Sb 45 " 55	1.9 op
Sb 40 " 60	2.9 op
Sb 35 " 65	3.9 op
Sb 30 " 70	4.8 op
Sb 25 " 75	5.2 op
Sb 20 " 80	4. op
Sb 15 " 85	7.1 op
Sb 10 " 90	7.3 op
Sb 5 " 95	6.3 op
~~Sb 90 Bi 10~~	~~2.4~~
~~Sb 85 " 15~~	~~2.1~~
Zn 90 Sn 10	.1
" 85 " 15	.1
" 80 " 20	.0
" 75 " 25	0

Zn 75 Sn 25	0
" 70 " 30	0
" 65 " 35	0
" 60 " 40	0
" 55 " 45	0
" 50 " 50	0
" 45 " 55	0
40 60	0
35 65	0
" 30 " 70	0
25 75	.1 opp
20 80	.1 op
15 85	.1 op
10 90	.1 op
5 95	.1 op
Sb 95 Hg2S 5	3.5
Sb 90 " 10	3.3
" 85 " 15	3.1
" 80 " 20	3
" 75 " 25	3
" 70 " 30	2.9
65 35	2.9
60 40	2.9
55 45	2.5
50 50	0
45 55	0
40 60	0
" 65	2.5
30 70	0

Sb 95	5	3.	KYYo ?
" 90	" 10	3	
85	" 15	3	
80	" 20	2.9	
75	25	0	
Sb 95 Nalls	5	2.5	
" 90	" 10	2.8	
" 85	15	2.3	
80	20	2.5	
75	25	2.2	
70	30	2	
65	35	2.5	
60	40	1.9	
Sb 95 (2x95 3x5)	5	2.9	
" 90	" 10	3.7	
85	" 15	3.9	
80	" 20	4.2	
75	" 25	6.	
70	" 30	8.5	
65	" 35	8.	
60	" 40	10.	
55	45	6.9	

Sb 50 (Zn 95 Sn 5)	50	6.9
" 45	" 55	2.5
40	" 60	1.8
35	" 65	1.1
30	" 70	.9
25	" 75	.9
20	80	.5
15	85	.4
10	90	0
5	95	0

Zn 50 Sn 50)	= Sb 95	1.9
"	10 90	1.8
"	15 85	1.8
	20 80	1.8
	25 75	1.8
	30 70	2.
	35 65	2.
	40 60	2.
	45 55	1.2
	50 50	3.
	55 45	3.
	60 40	1.9
	65 35	1.8
	70 30	.5
	75 25	2
	80 20	0
	85 15	0
	90 10	0
	95 5	0

Alloy Zn 65 / Sn 35	
5 – 5 to 95	1.9
10 — 90	2.
15 — 85	2.
20 — 80	2.1
25 — 75	2.3
30 — 70	2.3
35 — 65	2.5
40 — 60	2.9
45 — 55	2.1
50 — 50	1.9
55 — 45	1.4
60 — 40	1.
65 — 35	.8
70 — 30	.6
75 — 25	.4
80 — 20	.1
85 — 15	.1
90 — 10	0.
95 — 5	0.

Alloy Zn 80 Sn 20	Sb		
	5	95	1.9
	10	90	2.4
	15	85	2.5
	20	80	2.4
	25	75	3.
	30	70	4.
	35	65	3.3
	40	60	5.
	45	55	8.2
	50	50	4.5
	55	45	3.
	60	40	1.2
	65	35	1.
	70	30	1.
	75	25	.8
	80	20	.2
	85	15	.1
	90	10	0.
	95	5	0.

Alloy

Zn 70 / Sn 30

5	Sb 95	2.
10	90	2. 2
15	85	2. 5
20	80	3.
25	75	3. 3
30	70	3. 7
35	65	4. 4
40	60	4. 1
45	55	4. 9
50	50	3. 8
55	45	2. 2
60	40	1. 5
65	35	1. 5
70	30	.8
75	25	.4
80	20	.3
85	15	.2
90	10	0.
95	5	0

Alloy
Zn 75
Sn 25

Sn	Sb	95
10	90	1.9
15	85	2.8
20	80	2.9
25	75	3.2
30	70	3.9
35	65	3.8
40	60	5
45	55	4.8
50	50	1.8
55	45	1.2
60	40	1.9
65	35	1.1
70	30	.5
75	25	.3
80	20	.2
85	15	.1
90	10	.1
95	5	0.

Alloy

Zn 5% 85 15 } 5 ~ 5½ 95 | 2.3

10	90	2.8
15	85	3.1
20	80	3.6
25	75	4.1
30	70	5.
35	65	6.7
40	60	6.8
45	55	4.5
50	50	1.9
53	45	1.5
60	40	1.
65	35	1.
70	30	.5
75	25	.2
80	20	.1
85	15	.1
90	10	0.
95	5	0.

Alloy
Zn 90
Sn 10

Sn	Sb	95
5	90	2.3
10	85	2.7
15	80	3.4
20	75	4.2
25	70	5.3
30	65	5.9
35	60	7.8
40	55	6.9
45	50	3.
50	45	4.
55	40	1.9
60	35	.2
65	30	.2
70	25	.1
75	20	.1
80	15	.2
85	10	0.
90	5	.1
95		.1

Zn 25 / Sn 75	Sb 95	1
5	90	1.3
10	85	1.3
15	80	1.3
20	75	1.3
25	70	1.
30	65	1.
35	60	1.
40	55	1.5
45	50	1.1
50	45	1.
55	40	.9
60	35	.5
65	30	.2
70	25	.1
75	20	.2
80	15	0.
85	10	0.
90	5	0.
95		

Alloy

Zn 30 Sn 70	Sb		
	5	95	1.4
	10	90	1.4
	15	85	1.3
	20	80	1.3
	25	75	1.2
	30	70	1.1
	35	65	1.
	40	60	1.2
	45	55	1.1
	50	50	.9
	55	45	1.2
	60	40	.8
	65	35	.5
	70	30	.9
	75	25	.1
	80	20	.1
	85	15	.1
	90	10	0.
	95	5	0.

Alloy

Zn 40 Sn 60		
5	95	1.5
10	90	1.5
15	85	1.5
20	80	1.5
25	75	1.5
30	70	1.5
35	65	1.5
40	60	1.5
45	55	1.6
50	50	1.2
55	45	1.5
60	40	1.2
65	35	.8
70	30	1.5
75	25	.1
80	20	.1
85	15	0
90	10	0
95	5	.1 Offscale

Alloy
Zn 45
Sn 55

5	Sb 95	1.4
10	90	1.8
15	85	1.5
20	80	1.7
25	75	1.7
30	70	1.8
35	65	1.5
40	60	
45	55	1.8
50	50	1.8
55	45	1.2
60	40	.7
65	35	1.1
70	30	.3
75	25	.2
80	20	.2
85	15	.2
90	10	.1
95	5	0.

Alloy

Zn 55 / Sn 45

5	Sb 95	1.5
10	90	1.6
15	85	1.8
20	80	1.9
25	75	1.8
30	70	1.8
35	65	1.9
40	60	1.9
45	55	1.8
50	50	1.7
55	45	1.2
60	40	1.1
65	35	.8
70	30	.6
75	25	.5
80	20	.2
85	15	.1
90	10	0.
95	5	0.

Alloy

Zn 60 Sb 40		
5	Sb 95	1.7
10	90	1.9
15	85	1.8
20	80	2.
25	75	2.
30	70	2.1
35	65	2.2
40	60	1.7
45	55	6.5
50	50	2.5
55	45	1.8
60	40	1.5
65	35	1.5
70	30	.8
75	25	.2
80	20	.1
85	15	0.
90	10	0.
95	5	0.

Alloy

Zn 35 / Sn 65	5	Sb 95	1.1
	10	90	1.
	15	85	1.2
	20	80	
	25	75	1.2
	30	70	1.1
	35	65	1.1
	40	60	1.
	45	55	1.2
	50	50	1.8
	55	45	.8
	60	40	.9
	65	35	.7
	70	30	.4
	75	25	.1
	80	20	.1
	85	15	0.
	90	10	0.
	95	5	0.

Zn 15 / Sn 85		
5	95	.9
10	90	1.1
15	85	1.
20	80	1.
25	75	.9
30	70	.8
35	65	.8
40	60	.8
45	55	.9
50	50	.9
55	45	.7
60	40	.8
65	35	.6
70	30	.7
75	25	.4
80	20	.3
85	15	.1
90	10	.0
95	5	.1 opp

Zn 20 Sn 80	5	Sb 95	.9
	10	90	1.1
	15	85	1.3
	20	80	1.2
	25	75	1.
	30	70	1.
	35	65	1.
	40	60	1.
	45	55	1.
	50	50	1.
	55	45	1.
	60	40	.9
	65	35	.8
	70	30	.2
	75	25	.2
	80	20	.1
	85	15	0.
	90	10	0.
	95	5	1/10 opposite

Zn 10 Sn 90	5	Sb. 95	.9
	10	90	1.2
	15	85	1
	20	80	.9
	25	75	.9
	30	70	.8
	35	65	.8
	40	60	.8
	45	55	.9
	50	50	.9
	55	45	.5
	60	40	.5
	65	35	.2
	70	30	.1
	75	25	0.
	80	20	.1 Hydrolic
	85	15	.1 "
	90	10	.1 "
	95	5	.1 "

Zn 5 / Sn 95		
5	95	.9
10	90	1.1
15	85	1.1
20	80	.9
25	75	.8
30	70	.8
35	65	.5
40	60	.5
45	55	.6
50	50	.6
55	45	.5
60	40	.4
65	35	.2
70	30	.2
75	25	.1
80	20	.1
85	15	.1
90	10	.1
95	5	.1

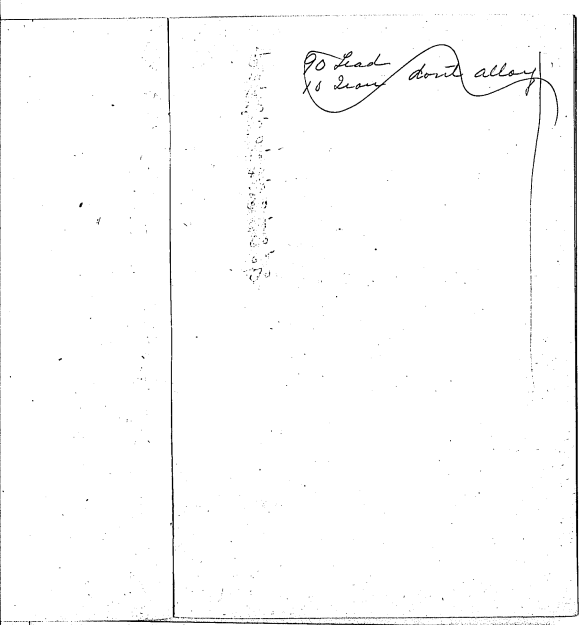
opposite
"
"
"

Zn 5 — Sb 95 — 3.2

Bismuth 95

5	95	3.2	
10	90	2.8	
15	85	2.8	
20	80	2.5	
25	75	2.8	
30	70	2.4	
35	65	2.1	
40	60	1.7	
45	55	1.6	
50	50	2.	
55	45	.1	opposite
60	40	.2	
65	35	1 degree	opposite
70	30	3.9	opposite
75	25	3.4	"
80	20	4.1	"
85	15	5.8	"
90	10	7.7	"
95	5	4.9	"

Hard Magnetite One deg opposite —
Stibnite SbS Native 0 —
Brookite — .1 deg - neg
Galena 14 to 1.5 Opp Bi Sides
fluctuates —
Molybdenite 0 —
Tourmaline 0
Meccanite .. 0 - magnets stick to white on jar
Rutile 0


90 Lead
10 Iron
don't alloy

Alloy Lead 90 Iron 10	1.0	Dont alloy.
Lead 80 Iron 20	.9	dont alloy
Lead 70 Iron 30	.5	dont alloy
Lead 60 Iron 40	.5	opposite, dont alloy
Lead 50 Iron 50	.6	opposite, dont alloy.
Tin 90 Nickel 10	.3	opposite
Tin 80 Nickel 20	.5	opposite
Tin 70 Nickel 30	1	opposite
Tin 60 Nickel 40	1.5	opposite
Tin 50 Nickel 50	2.2	opposite
Zinc 90 Nickel 10	1.7	opposite
Zinc 80 Nickel 20	1.4	opposite
Zinc 70 Nickel 30	1	opposite

alloy Zinc 80 Nickel 40	1	opposite
Zinc 50 Nickel 50	2.1	opposite
Zinc 80 Nickel 20 Duplicate	1.6	opposite (not found in books)
Antimony 90 Nickel 10	1.5	
Antimony 80 Nickel 20	1...	
Antimony 70 Nickel 30	.5	opposite
Antimony 60 Nickel 40	.6	opposite
Antimony 50 nickel 50	.3	opposite
Zinc 90 Cu 10	.1	
Zinc 80 Cu 20	0	
Zinc 70 Cu 30	.2	
Zinc 60 Cu 40	.5	opposite
Zinc 50 Cu 50	.1	opposite

Alloy		
Sb 90 Iron 10	1	
Sb 80 Iron 20	1	
Sb 70 Iron 30	.5	
Sb 60 Iron 40	.2	opposite
Sb 50 Iron 50	.6	opposite
Sn 90 Iron 10	.1	opposite
Sn 80 Iron 20	.2	opposite
Sn 70 Iron 30	.1	opposite
Sn 60 Iron 40*	.2	opposite (Gives vapor off on cold side
Sn 50 Iron 50	.2	opposite (Doesn't give vapor.

Phenomenon

* When a piece is held by tweezers between the Cold + Hot Cups but not touching a steam like Vapor rises from the Cold Cup — Other alloys don't do it except one tried back about 6 to 10 Numbers — This should be investigated

Alloy
Zn 90
Bismuth 10

5	Sb 95	3.2
10	90	3.7
15	85	4.2
20	80	4.5
25	75	5.4
30	70	6.9
35	65	13.9
40	60	12.8
45	55	[illegible]
50	50	9.9
55	45	8.1
60	40	2.5
65	35	1.4
70	30	1.2
75	25	.9
80	20	1
85	15	.7
90	10	.5
95	5	0

Alloy

Zinc 85
Bismuth 15

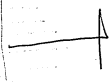
Sb	Zn	
5	95	3.4
10	90	3.9
15	85	4.1
20	80	5.6
25	75	6.8
30	70	8.8
35	65	15.3
40	60	14.9
45	55	8.5
50	50	8.
55	45	3.4
60	40	3.4
65	35	1.5
70	30	1.5
75	25	1.3
80	20	1.1
85	15	.1
90	10	.1
95	5	0

Alloy

Zinc 80

Bismuth 20

5	95	3.1
10	90	3.9
15	85	4.3
20	80	4.7
25	75	5.3
30	70	6.
35	65	8.9
40	60	10.8
45	55	8.9
50	50	5.5
55	45	3.4
60	40	2.9
65	35	1.8
70	30	1.5
75	25	1.5
80	20	1.4
85	15	.3
90	10	.2
95	5	0



Alloy	Sb	Bi	g	
Zinc 20 Bismuth 80	10	90	2.6	
	15	85	3.8	
	20	80	2.7	
	25	75	2.8	
	30	70	2.5	
	35	65	2.5	
	40	60	2.4	
	45	55	2.8	
	50	50	1.4	
	55	45	1.6	
	60	40	1.4	
	65	35	.3	
	70	30	.4	opposite
	75	25	.2	"
	80	20	1.4	"
	85	15	.3	"
	90	10	2.8	"
	95	5		

Alloy			
Zinc 90 Bismuth 5	5	95	3.4
	10	90	4.3
	15	85	4.8
	20	80	5.3
	25	75	6.
	30	70	17.9
	35	65	13.1
	40	60	14.9
	45	55	10.4
	50	50	4.7
	55	45	2.6
	60	40	1.8
	65	35	1
	70	30	.4
	75	25	.8
	80	20	.5
	85	15	.3
	90	10	.1
	95	5	0.

Alloy	5 Sb	95	2.9	
Zinc 10	10	90	2.8	
Bismuth 90	15	85	1.7	
	20	80	2.5	
	25	75	2.3	
	30	70	2.4	
	35	65	2.5	
	40	60	2.1	
	45	55	1.7	
	50	50	1.5	
	55	45	2.	
	60	40	1.7	
	65	35	1.5	opposite
	70	30	2	"
	75	25	4	"
	80	20	3.5	"
	85	15	5.9	"
	90	10	6	"
	95	5	4.4	"

Alloy	Sb	Bi		
Zinc 15 Bismuth 85	5	95	2.8	
	10	90	2.8	
	15	85	2.8	
	20	80	2.8	
	25	75	2.8	
	30	70	2.3	
	35	65	2.4	
	40	60	2.3	
	45	55	2.2	
	50	50	1.9	
	55	45	1	
	60	40	.5	
	65	35	.2	opposite
	70	30	1.4	"
	75	25	2.5	"
	80	20	3.5	"
	85	15	3.3	"
	90	10	2.8	"
	95	5	2.2	"

Alloy

Zinc 60
Bismuth 40

5 Sb	95	3.1
10	90	3.5
15	85	3.3
20	80	4.1
25	75	4.2
30	70	5.4
35	65	5.8
40	60	7.8
45	55	9.9
50	50	4.5
55	45	10.3
60	40	8.
65	35	2.8
70	30	2.
75	25	1.8
80	20	.8
85	15	0
90	10	.2
95	5	0

Alloy

Zinc 60
Bismuth 35

Sb	Bi	
5	95	3
10	90	3.8
15	85	3.8
20	80	4.
25	75	4.3
30	70	5.3
35	65	5.8
40	60	8.3
45	55	11.6
50	50	10.
55	45	7.8
60	40	3.3
65	35	2.5
70	30	2.8
75	25	2.8
80	20	2.
85	15	2
90	10	.2
95	5	0

Alloy
Zinc 70
Bismuth 30

Sb	Pb	
5	95	3.2
10	90	2.9
15	85	3.9
20	80	4.2
25	75	4.5
30	70	6.1
35	65	8.
40	60	8.8
45	55	10.3
50	50	7.5
55	45	6.6
60	40	3.3
65	35	2.2
70	30	2.5
75	25	1.1
80	20	1.8
85	15	.5
90	10	.2
95	5	.2 opposite.

Alloy			
Zinc 75 / Bismuth 25	5	95	2.5
	10	90	3.2
	15	85	3.5
	20	80	3.9
	25	75	4
	30	70	5.
	35	65	6.
	40	60	9.9
	45	55	12.8
	50	50	10.9
	53	45	3.6
	60	40	3.
	65	35	1.6
	70	30	[illegible]
	75	25	2.4
	80	20	1.5
	85	15	.5
	90	10	1.2
	95	5	.1

Pb 90
As 10 — .1 opposite

.13 g. of As in
15 g Pb 0

Tried Pb second time and put 5 gr of Co as in 15 gr. of Pb

5 gr. of Co As
in 15 gr. Pb. .1 opposite

5 g. as in
15 g. of Sn .5

1.18 gr Co As 1.9
in 15g Sn

Put 4 g. of As 0
in 80g of Pb.

1.2 g of as in
15 g of zinc rolled not calcu

.9 g of As rolled not calcu
in 15 g of Co

Alloy
Tin 75
Bismuth 25

5	Sb	95	1.1
10		90	1.3
15		85	1.1
20		80	.9
25		75	.8
30		70	.8
35		65	.7
40		60	.8
45		55	.8
50		50	.8
55		45	.7
60		40	.6
65		35	.5
70		30	.3
75		25	.2
80		20	.1
85		15	.1
90		10	.1 opposite
95		5	.1 "

Alloy

Tin 80
Bismuth 20

5 Sb	95	.9
10	90	1.1
15	85	1.
20	80	.9
25	75	.9
30	70	.8
35	65	.8
40	60	.8
45	55	.7
50	50	.6
55	45	.6
60	40	.5
65	35	.5
70	30	.4
75	25	.3
80	20	.1
85	15	0
90	10	0
95	5	0

Alloy

Tin 85
Bismuth 15

5 Sb 95	/
10	1.1
15	1
20	.9
25	.9
30	.8
35	.8
40	.6
45	.6
50	.5
55	.5
60	.3
65	.2
70	.1
75	.1
80	0
85	0
90	0
95	

Alloy	Sn	Sb	Bi	
Tin 90 Bismuth 10	5	5	95	.9
	10		90	1
	15		85	1
	20		80	.9
	25		75	.9
	30		70	.8
	35		65	.8
	40		60	.7
	45		55	.5
	50		50	.5
	55		45	.4
	60		40	.3
	65		35	.2
	70		30	.1
	75		25	.1
	80		20	.1
	85		15	0
	90		10	0
	95		5	.1 Upwards

Alloy

Tin 70
Bismuth 30

5	Sb	Sn	I
10		90	1.2
15		85	1.2
20		80	1
25		75	.9
30		70	.9
35		65	.8
40		60	.7
45		55	.8
50		50	.8
55		45	.8
60		40	.6
65		35	.5
70		30	.5
75		25	.4
80		20	.2
85		15	.1
90		10	0
95		5	0

Alloy

Zinc 45
Bismuth 55

5	Sb	95	3
10		90	3
15		85	3.2
20		80	3.1
25		75	3.4
30		70	4.1
35		65	3.9
40		60	4.7
45		55	7
50		50	5.4
55		45	6.2
60		40	6
65		35	3.5
70		30	2.9
75		25	1.5
80		20	.5
85		15	.5 approx
90		10	0.1 approx
95		5	1.4 approx

Alloy
Zinc 30
Bismuth 70

5	56	95	2.6
10		90	2.9
15		85	2.9
20		80	2.9
25		75	3.
30		70	3.
35		65	3.4
40		60	3.8
45		55	4.1
50		50	4.2
55		45	4.5
60		40	5.
65		35	4.1
70		30	3.6
75		25	2.8
80		20	2.9
85		15	1. opposite
90		10	1.2 "
95		5	1.9 opposite

Alloy

Zinc 35
Bismuth 65

5 Sb	95	2.9
10	90	3.2
15	85	3.4
20	80	3.4
25	75	3.5
30	70	4.
35	65	3.2
40	60	3.5
45	55	3.7
50	50	4.4
55	45	3.6
60	40	4.6
65	35	4.
70	30	3.2
75	25	1.
80	20	.6
85	15	.4 opposite
90	10	.5 "
95	5	2 opposite

Alloy

Zinc 50
Bismuth 50

5	Sb	95	2.8	
10		90	2.9	
15		85	3.3	
20		80	3.6	
25		75	3.8	
30		70	4.	
35		65	4.9	
40		60	5.	
45		55	6.	
50		50	9.4	
55		45	9.9	
60		40	8.4	
65		35	3.3	
70		30	2.5	
75		25	1.4	
80		20	.7	
85		15	.2	
90		10	.3	Sprinkle
95		5	1.4	"

Alloy
Zinc 40
Bismuth 60

5	Sb	95	3	
10		90	2.8	
15		85	3.3	
20		80	2.9	
25		75	3.2	
30		70	3.9	
35		65	3.8	
40		60	3.8	
45		55	3.9	
50		50	3.8	
55		45	4.8	
60		40	5.5	
65		35	5.3	
70		30	6.4	
75		25	1.8	
80		20	.5	
85		15	.1	opposite
90		10	.3	1
95		5	1	4

Alloy
Zinc 25
Bismuth 75

5	Sb	95	2.4
10		90	3.
15		85	2.7
20		80	2.7
25		75	2.9
30		70	2.9
35		65	3.3
40		60	3.2
45		55	3.
50		50	3.1
55		45	3.1
60		40	2.1
65		35	3.4
70		30	3.1
75		25	2.6
80		20	.4 opposite
85		15	/ "
90		10	/.3 "
95		5	2 "

Alloy				
Zinc 55 / Bismuth 45	5	Sb. 95	2.8	
	10	90	3.1	
	15	85	3.4	
	20	80	3.7	
	25	75	4.3	
	30	70	4.5	
	35	65	4.9	
	40	60	5.8	
	45	55	7.8	
	50	50	11.2	
	55	45	8.5	
	60	40	5.6	
	65	35	2.5	
	70	30	2.9	
	75	25	1.3	
	80	20	1	
	85	15	.1	
	90	10	.2	opposite
	95	5	1	

Alloy	Sb	Sn	
	5	95	1
	10	90	1.2
~~Zinc~~	15	85	1.1
Tin 5	20	80	1.9
Bismuth 95	25	75	1.6
	30	70	1.6
	35	65	1.5
	40	60	1.4
	45	55	1.4
	50	50	1.3
	55	45	1.3
	60	40	1.3
	65	35	1.2
	70	30	1.2
Tin 95	75	25	1.1
Bismuth 5	80	20	0
	85	15	0
	90	10	1 opposite
	95	5	1 "

Alloy	Sn	Sb	Pb	I
Tin 30 / Bismuth 70	10	20	70	1.9
	15	15	70	1.7
	20	10	70	1.3
	25	5	70	1.3
	30	0	70	1.3
	35	0	65	1.4
	40	0	60	1.2
	45	0	55	1.3
	50	0	50	1.4
	55	0	45	1.5
	60	0	40	1.5
	65	0	35	1.6
	70	0	30	1.9
	75	0	25	1.8
	80	0	20	1.8
	85	0	15	1.8
	90	0	10	1.7
	95	0	5	1.5

Alloy

Sn 45

Bismuth 55

.5	55	95	.44
10		90	1.2
15		85	1.2
20		80	1.2
25		75	1.2
30		70	1.1
35		65	1.2
40		60	1.
45		55	1.
50		50	1.
55		45	1.1
60		40	1.1
65		35	1.1
70		30	1.2
75		25	1.
80		20	1.
85		15	1.
90		10	.9
95		5	.9

Allory

Sin 65
Basement 35

5	95	1.1
10	90	1.
15	85	1.2
20	80	1.
25	75	1.
30	70	1.1
35	65	.9
40	60	.9
45	55	.8
50	50	.9
55	45	.9
60	40	.9
65	35	.8
70	30	.5
75	25	.5
80	20	.3
85	15	.1
90	10	0
95	5	0

Alley

Sta 35
Basement 60

	St.	
5	95	.9
10	90	1.2
15	85	1.3
20	80	1.4
25	75	1.4
30	70	1.3
35	65	1.2
40	60	1.2
45	55	1.1
50	50	1.4
55	45	1.3
60	40	1.5
65	35	1.5
70	30	1.6
75	25	1.8
80	20	1.8
85	15	1.8
90	10	1.2
95	5	1.2

Alloy

Sn 50

Bismuth 50

5	Sb	95	1.2
10		90	1.
15		85	1.3
20		80	1.2
25		75	1.1
30		70	1.
35		65	1.
40		60	1.
45		55	1.
50		50	1.
55		45	1.
60		40	1.
65		35	1.1
70		30	1.
75		25	1.
80		20	.9
85		15	.8
90		10	.7
95		5	.3

Alloy
Sn 60
Bismuth 40

	Sb.	
5	95	1.
10	90	1.2
15	85	1.3
20	80	1.2
25	75	1.
30	70	1.
35	65	.9
40	60	.9
45	55	.9
50	50	1.
55	45	.9
60	40	.9
65	35	1.
70	30	.9
75	25	.5
80	20	.5
85	15	.3
90	10	0.
95	5	0.

Alloy
Sn 5-5
Bismuth 45

5	95	1.1
10	90	1.2
15	85	1.2
20	80	1.2
25	75	1.2
30	70	1.
35	65	1.
40	60	1.
45	55	1.
50	50	1.
55	45	1.
60	40	1.
65	35	1.
70	30	1.
75	25	.9
80	20	.8
85	15	.5
90	10	.4
95	5	0.

Alloy
Sec 4 &
Discard - 60

5	Sd.	95	1
10		90	1.4
15		85	1.3
20		80	1.2
25		75	1.1
30		70	1.1
35		65	1.1
40		60	1.
45		55	1.
50		50	1.
55		45	1.1
60		40	1.2
65		35	1.3
70		30	1.4
75		25	1.5
80		20	1.8
85		15	0.5
90		10	1.1
95		5	1.2

Alloy
Pt 5-
Ir 95-

5-	St.	95-	3
10		90	2.6
15		85-	2.7
20		80	2.5
25-		75-	2.3
30		70	2.1
35-		65-	2.1
40		60	1.9
45-		55-	2.
50		50	1.8
55-		45-	1.4
60		40	1.3
65-		35-	1.5
70		30	.9
75-		25-	.5
80		20	.2
85-		15-	.1 offsilt
90		10	.1 offsilt
95-		5-	1.5 "

alloy

Pb 10	5- 2lb.	95-	2.8
Bi 90	10	90	2.4
	15-	85-	2.2
	20	80	2.
	25-	75-	2.1
	30	70	2.1
	35-	65-	2.
	40	60	2.
	45-	55-	2.
	50	50	1.9
	55-	45-	1.9
	60	40	1.9
	65-	35-	2.
	70	30	1.9
	75-	25-	1.2
	80	20	2
	85-	15-	1.9
	90	10	2.
	95-	5-	1.

Alloy	5	Sb.	95	2.3
Pb. 15	10		90	2.1
Bi. 85	15		85	2.
	20		80	1.9
	25		75	1.9
	30		70	2
	35		65	1.9
	40		60	2
	45		55	2.
	50		50	2.
	55		45	2
	60		40	1.9
	65		35	2
	70		30	1.9
	75		25	2
	80		20	2
	85		15	1.8
	90		10	2.
	95		5	1.6

Albany St.

Bl-Bi	5"	95"	2.5
Bi-80	10	90	2.
	15"	85"	1.9
	20	80	1.9
	25"	75"	1.9
	30	70	2.
	35"	65"	1.8
	40	60	1.4
	45"	55"	1.8
	50	50	1.7
	55"	45"	1.8
	60	40	1.6
	65"	35"	1.8
	70	30	1.6
	75"	25"	2
	80	20	2.
	85"	15"	2.
	90	10	2.
	95"	5"	1.9

Allow	.5	Sh	95	2.2
PL 5	10		90	2.1
Bi 75	15		85	2.
	20		80	1.7
	25		75	1.5
	30		70	1.5
	35		65	1.5
	40		60	1.4
	45		55	1.6
	50		50	1.7
	55		45	1.2
	60		40	1.4
	65		35	1.2
	70		30	1.5
	75		25	1.3
	80		20	1.5
	85		15	1.5
	90		10	3.
	95		5	2

Along Surf 25- Bi 75-	5-	95-	2
	10	90	1.8
	15-	85-	1.9
	20	80	1.9
	25-	75-	1.9
	30	70	2
	35-	65-	1.8
	40	60	1.6
	45-	55-	1.5-
	50	50	1.5-
	53-	45-	1.5-
	60	40	1.5-
	65-	35-	1.5-
	70	30	1.5-
	75-	25-	1.5-
	80	20	1.1
	85-	15-	1.2
	90	10	1.
	95-	5-	1.

Alloy
Pb 30
Bi 70

	Sb		
5		95	2.1
10		90	2.
15		85	1.5
20		80	1.1
25		75	1.1
30		70	1.1
35		65	1.1
40		60	1.
45		55	1.
50		50	1.1
55		45	1.
60		40	1.
65		35	1.1
70		30	1.2
75		25	1.2
80		20	1.3
85		15	1.5
90		10	1.6
95		5	1.7

Allen Pk 35 Bi 65	0	95	1.9
	10	90	1.6
	15	85	1.2
	20	80	1.1
	25	75	1.
	30	70	1.
	35	65	.9
	40	60	1.
	45	55	.9
	50	50	1.
	55	45	1.
	60	40	.9
	65	35	1.
	70	30	1.
	75	25	1.
	80	20	1.1
	85	15	1.1
	90	10	1.1
	95	5	1.9

Alloy			
Sn 5	5	95	2.
Ai 95	10	90	1.9
	15	85	1.5
	20	80	1.
	25	75	1.2
	30	70	1.4
	35	65	1.6
	40	60	2.
	45	55	2.1
	50	50	2.6
	55	45	2.9
	60	40	3.
	65	35	3.5
	70	30	3.2
	75	25	4.
	80	20	4.3
	85	15	4.1
	90	10	4.5
	95	5	4.9

Alley	5	95	1.1
Surf 15	10	90	1.
Bi 85	15	85	1.4
	20	80	1.
	25	75	1.6
	30	70	1.9
	35	65	1.9
	40	60	1.9
	45	55	1.9
	50	50	2.
	55	45	2.
	60	40	1.9
	65	35	2.
	70	30	2.1
	75	25	2.1
	80	20	2.5
	85	10	2.5
	90	10	2.9
	95	5	2.2

Alloy	Sn	Sb	Pb	I
Sn 20				
Bi 80				
	5	5	90	1
	10		90	1
	15		85	1.1
	20		80	1.3
	25		75	1.6
	30		70	1.85
	35		65	1.7
	40		60	1.9
	45		55	1.9
	50		50	1.9
	55		45	1.9
	60		40	2.
	65		35	2.
	70		30	2.
	75		25	2.
	80		20	2.1
	85		15	2.1
	90		10	2.1
	95		5	2.6

Alloy			
Sn 10	5	St. 95	1.9
Bi 90	10	90	1.
	15	85	1.1
	20	80	1.1
	25	75	1.5
	30	70	1.6
	35	65	1.8
	40	60	2.
	45	55	2.1
	50	50	2.1
	55	45	2.3
	60	40	2.5
	65	35	2.5
	70	30	2.9
	75	25	2.9
	80	20	3.
	85	15	3.
	90	10	3.4
	95	5	3.1

Allen	5	95	1.9
Pb 40	10	90	1.2
Bi 40	15	85	1.
	20	80	.9
	25	75	.9
	30	70	.6
	35	65	.5
	40	60	.5
	45	55	.5
	50	50	.4
	55	45	.4
	60	40	.3
	65	35	.5
	70	30	.3
	75	25	.2
	80	20	.1
	85	15	.1
	90	10	.1
	95	5	0.

Alloy	5	95	2.
Pb 40	10	90	1.5
Bi 60	15	85	1.1
	20	80	1.
	25	75	1.
	30	70	1.
	35	65	.9
	40	60	.9
	45	55	.8
	50	50	.9
	55	45	.8
	60	40	.9
	65	35	.9
	70	30	.9
	75	25	.9
	80	20	.9
	85	15	1.
	90	10	.9
	95	5	.9

Alley
Bl 45-
Bi 55-

5-	Sh-	95-	2
10		90	1.8
15-		85-	1.2
20		80	1
25-		75-	1
30		70	1
35-		65-	.9
40		60	.8
45-		55-	.8
50		50	.8
55-		45-	.6
60		40	.7
65-		35-	.5-
70		30	.7
75-		25-	.7
80		20	.7
85-		15-	.7
90		10	.4
95-		5-	.4

Alloy				
pt 5-8	5	St	95	1.9
2i 50	10		90	1.8
	15		85	1.7
	20		80	1.6
	25		75	.8
	30		70	.8
	35		65	.7
	40		60	.7
	45		55	.6
	50		50	.6
	55		45	.6
	60		40	.5
	65		35	.5
	70		30	.5
	75		25	.5
	80		20	.4
	85		15	.4
	90		10	.4
	95		5	.2

Alley	5- St	95-	1.9
Pol 55-	10	90	1.5
Bi 45-	15	85	1.1
	20	80	.9
	25	75	.8
	30	70	.7
	35	65	.6
	40	60	.5
	45	55	.6
	50	50	.5
	55	45	.6
	60	40	.4
	65	35	.4
	70	30	.4
	75	25	.3
	80	20	.2
	85	15	.2
	90	10	.1
	95	5	0

Alley	5 St	95	3.6
Call 95	10	90	4.
Bi 5	15	85	4.5
	20	80	4.1
	25	75	4.8
	30	70	6.2
	35	65	7.9
	40	60	
	45	55	10.2
	50	50	11.
	55	45	17.3
	60	40	11.3
	65	35	9.9
	70	30	16.8
	75	25	.5
	80	20	1.2
	85	15	1.
	90	10	.8
	95	5	.4

Alloy		Sb		
Cd 90	5		95	3.3
Bi 10	10		90	4.1
	15		85	4.4
	20		80	4.8
	25		75	5.7
	30		70	5
	35		65	5
	40		60	5.2
	45		55	6.
	50		50	7.9
	55		45	10
	60		40	4.5
	65		35	15
	70		30	5.
	75		25	10.9
	80		20	.9
	85		15	1.2
	90		10	.7
	95		5	.5

Alloy	5 St	95	3.8
Cu .85	10	90	4.2
Ri .15	15	85	4.
	20	80	4.9
	25	75	4.5
	30	70	5.9
	35	65	6.2
	40	60	4.9
	45	55	8.9
	50	50	10.
	55	45	10.9
	60	40	8.9
	65	35	4.8
	70	30	.5
	75	25	.5
	80	20	1.
	85	15	.7
	90	10	.5
	95	5	.2

Alloy	5	95	3.8
Al 80	10	90	4.
Ni 20	15	85	4.5
	20	80	5.2
	25	75	4.1
	30	70	5.9
	35	65	6.9
	40	60	6.
	45	55	6.2
	50	50	7.
	55	45	9.5
	60	40	4.5
	65	35	1.5
	70	30	1.
	75	25	.9
	80	20	.5
	85	15	.5
	90	10	.3
	95	5	.2

Alk	5	95	3.6
Cl 75	10	90	3.5
Bi 25	15	85	4.1
	20	80	4.2
	25	75	5.
	30	70	5.9
	35	65	6.2
	40	60	6.8
	45	55	7.5
	50	50	9.3
	55	45	9.2
	60	40	10.9
	65	35	2.9
	70	30	1.6
	75	25	1.2
	80	20	1.8
	85	15	.5
	90	10	.3
	95	5	.1

Alloy			
Cd 60 Bi 40	5	95	3.2
	10	90	3.8
	15	85	4.
	20	80	3.9
	25	75	4.5
	30	70	4.9
	35	65	5.3
	40	60	5.6
	45	55	6.
	50	50	7.
	55	45	7.9
	60	40	8.
	65	35	3.
	70	30	2.5
	75	25	1.
	80	20	.44
	85	15	.2
	90	10	.2
	95	5	0

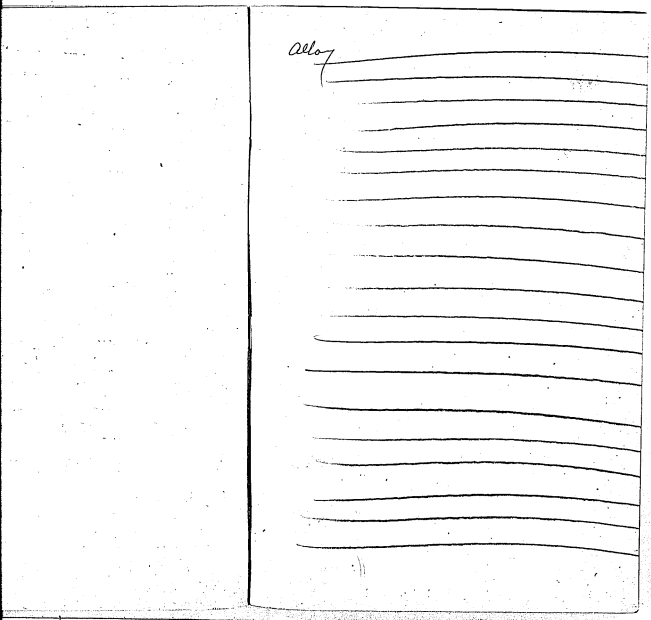
Alley	5	95	3.2
Cd. 5%	10	90	3.6
Bi 45	15	85	3.9
	20	80	3.9
	25	75	4.3
	30	70	4.4
	35	65	4.9
	40	60	5.3
	45	55	5.5
	50	50	6.2
	55	45	6.3
	60	40	6.9
	65	35	6.
	70	30	2.
	75	25	2.5
	80	20	1
	85	15	.2
	90	10	.1
	95	0	0

Alloy	Sn	Pb	
Cd 50	5	95	3.2
Bi 50	10	90	3.5
	15	85	3.2
	20	80	3.8
	25	75	4.
	30	70	4.4
	35	65	4.5
	40	60	5
	45	55	4.5
	50	50	4.9
	55	45	5.
	60	40	5.2
	65	35	4.8
	70	30	2.4
	95	25	.5
	80	20	.5
	85	15	0
	90	10	Lopposite
	95	5	.4

Alloy
Cd 40
Bi 55

5	95	3.2
10	90	3.4
15	85	3.7
20	80	3.5
25	75	4.
30	70	4.
35	65	4.1
40	60	4.
45	55	4.
50	50	4.2
55	45	4.2
60	40	3.8
65	35	3.9
70	30	3.
75	25	1.2
80	20	.2
85	15	.5
90	10	.1 Cpl crit
95	5	.2 4

Alloy	S-	Sb	Sn-	
Cd 40	10		90	3.2
Bi 60	15		85	3.2
	20		80	3.2
	25		75	3.6
	30		70	3.9
	35		65	3.8
	40		60	3.4
	45		55	3.8
	50		50	3.3
	53		45	3.2
	60		40	1.5
	65		35	2.5
	70		30	1.4
	75		25	2 appeals
	80		20	.4 "
	85		15	.3 "
	90		10	.1 "
	95		5	.6 "



Alley	5	95	3
Rd 36	10	90	3.2
Rd 65	15	85	3.2
	20	80	3.5
	25	75	3.8
	30	70	3.6
	35	65	3.7
	40	60	3.5
	45	55	3.1
	50	50	3.9
	55	45	3.9
	60	40	3
	65	35	4.1
	70	30	3.1
	75	25	1.9
	80	20	.2 opposite
	85	15	.1
	90	10	.3 opposite
	95	5	1 "

Alloy:	5	St. 95	3
Cd 30	10	90	3.1
Bi 70	15	85	3.
	20	80	3.1
	25	75	3.2
	30	70	3.3
	35	65	3.5
	40	60	3.6
	45	55	3.3
	50	50	3.1
	55	45	3.7
	60	40	8.8
	65	35	3.5
	70	30	3.8
	75	25	9.3
	80	20	1
	85	15	.5
	90	10	.2 approx
	95	5	.8 "

Alloy	5-	St	95-	1.5
Pb 95-	10		90	1
Bi 5	15		85	.9
	20		80	.8
	25		75	.8
	30		70	.7
	35		65	.6
	40		60	.6
	45		55	.6
	50		50	.6
	55		45	.5
	60		40	.4
	65		35	.3
	70		30	.2
	75		25	.1
	80		20	.1
	85		15	0
	90		10	0
	95		5	.1 Annealed